



TRANSMITTING

The Museum of Communication Foundation Trust Members' Newsletter

No. 110

December 2025



**MoC
TV**

**Merry Christmas and
Best Wishes for 2026
to all our Members
and Supporters**

Museum of Communication Goudie Lecture

Tactics, Politics and British Engineering: The Rise and Fall of TSR-2



Dr David Greig

11.30 am on Saturday 24 January 2026

followed by buffet lunch for in-person attendees

**131 High Street, Burntisland KY3 9AA
or by Zoom**

The terrain following radar developed for TSR-2 by Ferranti in Edinburgh was every bit as advanced as the jet bomber and though the two never flew together, a promotional film produced by Ferranti in the mid-1960s shows an astonishing engineering achievement with the technology available at that time. Centred round this film, the talk gives the background to the TSR-2 project and the consequences to the British aircraft and avionics industry from its eventual cancellation.

**To attend in person, e-mail enquiries@mocft.co.uk
Zoom link will be e-mailed to Members and Supporters**

EDITORIAL

At the Museum's AGM, Dorothy Brankin stood down from the Board, having previously intimated her intention not to seek re-election.

This is truly the end of an era for the Museum. Dorothy had been a Board Member from the Museum's foundation as an independent body in January 1992 and, throughout that time, was a major driving force along with her late husband, Peter. Even before that, she had been a leading light in the Friends of Bo'ness Heritage, in which she championed the late Harry Matthews, his collection and his vision. Following Harry's death, she saw it as her role to continue his mission, resulting in the Museum that we have today.

Now in her 80s and following a number of health challenges, Dorothy has now taken up residence at a care home, where she is very comfortable and well looked after. She remains keenly interested in the Museum and we wish her a comfortable and happy retirement.

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This edition of *Transmitting* has exhausted our current stock of articles. Whether we have a February edition will depend on our members submitting articles. We can only produce four editions per year if we have sufficient material. Sometimes we can only manage three. **Please help us by submitting an article for publication - see below.**

Please contribute to *TRANSMITTING*

E-mail your contributions to dwbrown384@sky.com or post them to The Editors, *Transmitting*, 16 Linden Avenue, STIRLING FK7 7PQ to arrive by **16 January 2026**.

The views and opinions expressed in *Transmitting* are solely those of the authors and not those of the Museum of Communication Foundation Trust.

MUSEUM AGM 2025

The 2025 AGM was held on Saturday 8 November at 131 High Street, Burntisland, with 30 members present in person and a further six joining online via Zoom.

CHAIRMAN'S REPORT

Following the usual welcome, apologies and approval of previous minutes, Tom Stevenson explained that his Chairman's Report would cover the period from the last AGM in November 2024 until the present time, whereas the Treasurer's Report would be concerned with the Financial Year from 1 April 2024 to 31 March 2025.

Tom opened his report by quoting our Mission Statement: *'Using our extensive Collection, we shall inform, educate and entertain the public with the exciting developments in communications technology which have given rise to the way of life we enjoy today'*.

Activities 2024-2025

Collections management has continued apace, thanks largely to the efforts of Dave Pack in carrying on the excellent work pioneered by the late Ian Smith.

Transmitting continues to be circulated regularly by electronic means.

The website continues to be updated.

Workshop activity is continuing.

The 2025 exhibition opened early in May and attracted around 1,400

visitors. The primary theme was 100 years of television. The visitor numbers were enhanced by an initiative of Mervin Hagger and Kath Hill in speaking to passers-by in the street and encouraging them in.

We were able to secure grant assistance for the installation of a new fire alarm system, led by Dave Pack, and for development of display facilities in the stairwell, led by John Blackie.

Goudie Lectures continue to be offered, both within the Museum and, thanks to the technical expertise of Paul Mauchline, on Zoom. However, they attracted fewer attendees than last year.

There were no outreach visits to schools this year, but there were visits to the Museum by Cub Scout and Beaver groups, the Lothians Radio Society and community organisations. There were also talks to Probus and other clubs.

The Museum of Communication Amateur Radio Station (MoCARS) continued to operate under the leadership of Ken Horne.

We were able to host a joint lecture with the Lothians Radio Society, where the speaker was Peter Bates. He took as his subject various aspects of the often-overlooked 'Y' (wireless interception) Service in World War II, which provided the raw material for decryption and traffic analysis at Bletchley Park.

The Microwave Conference took place as usual in November 2024 and returned on Saturday 1 November 2025. This was, as usual, a highly successful event that, this year, attracted 48 attendees.

Tom Stevenson took part in the Orkney International Science Festival in September, presenting two lectures. The first was entitled *History of Sound Recording and Playback* and the second *A Spinning Disk for Stookie Bill*, which dealt with the pioneering work of John Logie Baird.

The Museum was fortunate to obtain a replica of a late example of a Baird Televisor that had been built in 2020 by Ken Skeldon of the University of Glasgow. The room at the University in which it was stored was required for other purposes and Ken wished the Televisor to go somewhere that it would be of use.

Building maintenance work continued. A useful development was flooring of the attic by Peter Barclay and Tom Stevenson. Although the floor cannot bear any great weight, it has proved useful for storage of the Museum's extensive valve collection.

This part of the presentation was accompanied by a show of slides illustrating these activities.

Some Challenges

Exhibitions can be successful only if volunteers come forward to staff them. We struggled on some Saturdays to attract sufficient Exhibition volunteers, but did not have to close on any day.

It is necessary to maintain income, while adapting to changing conditions.

Maintaining the building, often involves onerous physical work by predominantly elderly volunteers.

It is essential to the Museum's future that we attract younger volunteers. Appealing to the younger generation continues to be a challenge. However, we are grateful to William Cameron and Cam Dickson for coming to join us and lowering the average age of our active members!

Recruiting volunteers of all ages is an essential. An increased number of volunteers means more flexibility in staffing exhibitions and in carrying out display and restoration work. A large number of volunteers each doing a little can often achieve more than a few volunteers each doing a lot.

We need to develop more outreach activities to increase public awareness of the Museum and perhaps attract some more volunteers.

Forward Planning

Tom Stevenson itemised our most important priorities:

To maintain income and thereby cover costs.

To pursue further sources of grant funding.

To raise our on-line profile by various means.

To continue Collections Management activity, update documentation and maintain

standards of collection care. The Museum's accreditation is due for reassessment and renewal in 2026. The deadline for submitting an application was at the end of November. We have been fortunate in securing the services of Jane Freel, Curator (Collections) at Fife Cultural Trust as our Curatorial Adviser/Mentor, as the successor of Dallas Mechan. It is a requirement for accreditation that we have someone in this position.

To respond to members' ideas and other inputs.

To expand our outreach activities even further.

And, above all, to make Science and Engineering fun!

Acknowledgements

In conclusion, Tom Stevenson thanked all our volunteers, members, office bearers and board members, the editors of *Transmitting*, our generous donors, our partner organisations, particularly the Burntisland Heritage Trust and Lothians Radio Society, and all who have helped to promote the MoC for their continuing support. In particular, voluntary contributions – including one large donation - had been the primary reason that we were able to show a modest surplus this year.

Tom Stevenson then invited questions, but such was the comprehensive nature of his presentation that none were forthcoming.

TREASURER'S REPORT

Tom then invited Andrew Starling to present his Treasurer's Report. Andrew reminded the members that copies of the Accounts, in both full and abridged form, had been circulated prior to the meeting. He then led the members through a series of slides, explaining them as he went. In particular, he explained that we had moved from an accruals-based to a cash receipts and payments method of accounting. Consequently, the 2024 figures had been adjusted on that basis in order to facilitate a valid year-on-year comparison. The principal features were:

There was a surplus of £3,863, compared with a surplus last year of £1,330.

We had a total Income of £17,569, compared with £16,883 last year and a reduction in Expenses to £13,706 from £15,553 last year. The most significant reductions were in the cost of Insurance and in Repairs & Maintenance. Depreciation for the year was £767 (last year, £776).

Donations and legacies

Although Subscriptions remained fairly steady at £1,270. Donations from Members along with their Annual Subscriptions were down from £1,877 to £1,337. Andrew stated that the Board did not intend to raise subscription rates in the coming year, even though they had remained constant for some considerable time. He did, however, appeal to members

to include a voluntary additional donation when renewing their membership, as this was quite an important source of income.

There was a substantial increase in one-off donations, to £8,976 from £1,492 last year. The bulk of this arose out of a single donation of £8,000, for which we are extremely grateful. Without it, we would have returned a deficit this year.

Other Income

We held nine lectures (including at the AGM). During the year, these attracted only 276 people, compared with 345 the previous year and the year prior of 480. The total income from lectures was £1,795, an increase of £125 despite the reduced number of attendees.

There were no additions to Fixed Assets during the year. Depreciation for the year was £767, similar to last year's figure of £776.

Our bank balance at the end of the financial year stood at £20,578, an increase over last year's figure of £16,715.

Questions to Treasurer

Andrew Starling then invited questions and comments, but none were forthcoming.

Adoption of Report & Accounts

The Treasurer's Report and Accounts were adopted on the proposal of Ron Murray, seconded by Alison Wardlaw. Tom and Andrew will sign the Final Accounts and they will be accessible at the website of the Office of the Scottish Charity Regulator

(OSCR) or on the Companies House website - just search for the Museum of Communication.Foundation Trust.

ELECTION OF EXECUTIVE BOARD

Tom reminded Members that Directors are appointed for three years and, if they wish to continue, must stand for re-election. This year it was the turn of Ian Archibald, Marion McLean, Andrew Starling and Tom Stevenson to retire by rote. Iain Ross was co-opted and did not have to be elected. Dorothy Brankin has resigned due to suffering the effects of advancing years and is now resident at a care home in Larbert. Tom acknowledged her long years of dedicated service.

The retiring members were willing to stand for re-election and were re-elected on the proposal of Peter Barclay, seconded by Roger Hill. As there were no other nominations, the Executive Board continues to comprise: Ian Archibald, John Blackie, Ken Horne, Marion McLean, Dave Pack, Andrew Starling and Tom Stevenson, with Iain Ross as a co-opted member and Jane Freel as Professional Curatorial Adviser.

ANY OTHER COMPETENT BUSINESS

Energy costs: Terry Martini-Yates asked whether the installation of solar panels, for which grant assistance may be available, had been considered by the Board. A discussion ensued which highlighted

both the advantages and downsides of solar panels. However, an undertaking was given to look into this aspect again.

UK Government Budget: Phil Phillips asked if any consequences were likely to arise for the Museum out of the forthcoming UK Government Budget. Andrew Starling replied that no such consequences were anticipated.

As there was no further business, Tom thanked everyone for attending and closed the AG Meeting.

HARRY MATTHEWS MEMORIAL LECTURE

The AGM was followed by the annual Harry Matthews Memorial Lecture. Tom explained how the Museum's Goudie Lectures came into being, then introduced Dr Iain Scott FREng of Leonardo UK Ltd, whose lecture was entitled '80 Years of Airborne Radar'.

Dr Scott explained that, since June 1943, Leonardo and its predecessors – in particular Ferranti - have been developing world-leading avionics technology in Edinburgh, including

airborne radar, lasers and self-protection systems. He then explored key milestones in the development of airborne radar, from the Cavity Magnetron pioneered at Birmingham University during WWII, through to the advent of Multi-Function RF Systems. He illustrated these themes with a selection of Edinburgh-developed radar projects spanning the Ferranti, GEC, Marconi and Leonardo eras to create a most interesting presentation.

The lecture gave rise to a considerable number of detailed questions, which were duly answered by Dr. Scott. Tom Stevenson observed that the very first Goudie Lecture had been delivered by Dr John Roulston who had also sponsored Dr Scott's academic work. Dave Pack, a veteran of Ferranti in Edinburgh, then proposed a hearty vote of thanks.

BUFFET LUNCH

The event concluded with a buffet lunch, where in-person attendees were able to mix informally with other Members.

2026 EXHIBITION PLANNING MEETING

Dear Members,

As you will be aware, we had a successful exhibition during the past year commemorating the centenary of John Logie Baird's pioneering demonstration of early TV and the way in which television technologies had developed over the next century. We received some 1,500 visitors from May to October.

For 2026, the Board of Management has recently decided that as there is plenty of scope to extend the same theme of TV as last year's exhibition, particularly as the museum has acquired a working model of Baird's mechanical TV system and there are plenty of ways of presenting other parts of our collection to the public. We would hope to have some more interactive elements too.

We are keen to hear from members and supporters about your ideas for building the exhibition next year. An informal meeting will be held at **10.30 am on Wednesday 14th January 2026 at 131 High Street, Burntisland KY3 9AA.**

At this meeting the overall scope, design and action plan for the new exhibition can be agreed. We very much would like your input to this meeting and would be delighted to see you there.

Thanking you for your continual support and wishing you a Merry Christmas.

John Blackie

(Secretary of Board of Management)

3 ways to donate to your Museum

- 1. Donate online** at <https://museumofcommunication.org.uk/shop/>
- 2. Make a bank transfer to:**
Account Name: Museum of Communication Foundation
Account No: 00508399, Sort Code: 80-17-37
Be sure to include your name as a reference or we won't know who you are and your donation will be anonymous!
- 3. Send a cheque** payable to 'Museum of Communication' to:
Museum of Communication, 131 High Street, Burntisland KY3 9AA.

MUSEUM NEWS AND VIEWS

MUSEUM ACCREDITATION

Museum Accreditation is a voluntary scheme that sets nationally-agreed standards for museums in the UK. Museums Galleries Scotland is the assessing organisation in Scotland. Museums who hold the full Accreditation standard are invited to submit a return application every five years. Ours was submitted in time for the deadline of 30 November 2025.

As well as ensuring that we maintain proper standards, Accreditation is important when it comes to applying for grant assistance from various sources.

Museums Galleries Scotland currently have a backlog of returns to assess, so it may be a little while before we hear back from them. They will let us know when they have started our assessment.

NORTH WEST COMPUTER MUSEUM

We are always interested to hear about other museums with similar collections and objectives to ourselves. MoC Member Phil Phillips has alerted us to the North West Computer Museum in Leigh, Greater Manchester.

To find out more, see <https://www.nwcomputermuseum.org.uk/>. Note that you must wait until the home page has completed its retro loading procedure before you can scroll the page properly.

RANNOCH GETS AN AWARD

We were delighted to see that MoC Member Agnes Allan's dog Rannoch has won the Animal Award in the BBC Scotland *Make a Difference Awards*, announced in Glasgow on Sunday 28 September.

Rannoch is a Listening Dog and, with Agnes, makes weekly visits to Donibristle Primary School in Dunfermline for "Read to the Dog" sessions, in which pupils read stories to Rannoch to help their confidence in literacy. Agnes said, "I am so proud of Rannoch. She makes the difference. We've been to all sorts of places, care homes, Alzheimer's groups, special needs classes but I love Read to the Dog the most."



Agnes and Rannoch at the 'Make a Difference' award ceremony

LECTURE SUCCESSES

Our Goudie Lecture series continues to attract very high-calibre speakers and appreciative audiences.

On Wednesday 24 September, we hosted a joint lecture with the Lothians Radio Society, where the speaker was Peter Bates. He took as his subject various aspects of the 'Y' (wireless interception) Service in World War II, which provided the raw material for decryption and traffic analysis at Bletchley Park. Altogether, a most revealing account of an often-overlooked aspect of the secret war.

On Saturday 18 October, Roy Johnstone presented another fascinating lecture, this time entitled *Britain's Contribution to Victory in World War II*. One of the audience told us afterwards that it was the only time a speaker had been able to hold his attention completely for an hour.....and without any slides!

On Saturday 8 November, immediately following the Museum AGM, Dr Iain Scott FREng of Leonardo UK Ltd presented the annual Harry Matthews Memorial Lecture, '80 Years of Airborne Radar'. He explored key milestones in the development of airborne radar, emphasising in particular the Edinburgh-based research and development work carried out by Ferranti, GEC, Marconi and Leonardo at various periods.

Our 2026 lecture season starts off on Saturday 26 January 2026 - see page 2 of *Transmitting* for details.



Dr Mark Muir and Dave Pack talk informally with Roy Johnstone following his excellent lecture

GRMT SCOTTISH MICROWAVE ROUND TABLE

All the places for the 13th Scottish Microwave Round Table (GMRT) were fully booked ahead of the event, which took place in the Museum on Saturday 1 November. The gathering followed its usual successful format.

Museum volunteers happily gave a tour of the stores to those who were interested or who had not seen our collection before. A report and photos can be accessed at <https://gmroundtable.org.uk/>.



This photo gives a flavour of the event

SOLAR BATTERY INVERTER SURPRISE

Don Clarke, Edinburgh

(formerly GM3UIA in the 60s and 70s)

I bought a very old AR88 communications receiver which is thought to date from late 1942 or early 1943. It was in sore need of a bit of TLC, so I set out to restore it to operational condition. After replacing all the leaky bathtub capacitors and also one of the main power supply smoothing chokes the beast did indeed roar again. I attached a lump of wire as an antenna (in my garage) and tried it first on medium wave and 3 BBC AM radio stations were heard albeit not at top quality. I switched to the first short wave band and was very surprised to hear several very strong carrier signals but no discernable modulation on them. Further up in the frequency bands the same multiple strong carriers were detected. It took a while to dawn on me that these carriers, the frequency of which was not what you would describe as crystal controlled, were approximately 31kHz apart. Dozens of them!

Quite close to the bench on which the AR88 was being worked on is the electronics installation associated with my solar panels and domestic storage battery. What is the usual frequency for a DC to mains inverter to operate at? You guessed it – 31kHz. The inverter is rated at 3.6kW so internal switching is fairly high powered.

I could get nothing other than these carriers on the short wave bands so I moved the AR88 to the other end of the house. Guess what? Same problem, as of course, the switching transients were being radiated by the mains wiring in the house.

After aligning the RF and IF circuits in the receiver with the aid of a Marconi signal generator kindly loaned to me from the Museum of Communication I tried broadcast reception again. This time I used the metal track of my model railway (fairly large) as an internal antenna and hey presto! amateur radio was heard on the 21MHz band. At this high frequency the inverter interference had diminished somewhat so SSB (single sideband) reception was possible. Trying to listen to SSB amateurs showed up a fairly hefty shortcoming of the otherwise brilliant AR88, namely, resolving SSB audio clearly. The technique seemed to be to turn the audio gain way up and turn the RF gain way down as the level of BFO used to resolve SSB was woefully low. This got me researching ways how to improve SSB reception.

I found a schematic for a product detector which appeared to have been designed in 1995 by a Norwegian radio amateur whose callsign was LA8AK. This was duly

built and showed great promise over using the AR88's way of listening to SSB. A small second circuit board was designed and built to allow switching between the two outputs of the product detector. This used a CMOS switch (CD4052) powered with +8v (heater supply rectified) and -2V from the AR88's negative bias system.

One day while testing this product detector by listening to an English amateur on the 40m band, my wife came into the room and suggested the heating should be switched on. I agreed, then 60 seconds later a ghastly rough carrier came up very close to the frequency I was listening on. I switched the (gas central) heating (about a 300W load) off and hey presto, the carrier went away. But we weren't going to freeze just because I was listening to some CW

from Englandshire, so back on it went, and yes, the carrier came back again.

I decided to try to measure the level of the interference. By switching between the aerial and the signal generator I could guesstimate the level. As the frequency went up the interference level went down – this is pretty much what one would expect from ever higher harmonics of a low frequency source. The measured levels were well above what one would expect if the unit conformed with the EC regulations for radiation on both AC and DC ports, for example, I measured 125uV at 7MHz and more than double that at 3.5MHz.

Here is an extract from the test certificate they sent me (after a few “nags”)

DISTURBANCE VOLTAGE AT THE AC POWER PORT

4.2. Limits

EN 62920:2017+A1:2021

CISPR 11:2015+A1:2016

Class B

Frequency range MHz Quasi-peak dB(uV) Average dB(uV)

0.15 to 0.50 66 Decreasing linearly with 56 Decreasing linearly with
logarithm of frequency to 56 logarithm of frequency to 56

0.50 to 5 56 46

5 to 30 60 50

DISTURBANCE VOLTAGE AT THE DC POWER PORT

5.2. Limits

EN 62920:2017+A1:2021, Class B

Frequency range MHz Quasi-peak dB(uV) Average dB(uV)

0.15 to 0.50 84 Decreasing linearly with 74 Decreasing linearly with
logarithm of frequency to 74 logarithm of frequency to 64

0.5 to 30 74 64

There were all sorts of fancy graphs and plots of how good their emissions were which I wasn't able to copy from their test pdf file for some reason. Here is a spot value of emissions at the DC port with the PV panels producing max power (3.6kW) and the AC side exporting to the grid, or house (in my case).

At 13.3050 MHz, test peak output was 61.3dBuV with a limit of 74dBuV which obviously passes the EN62920 class B criteria.

However, 6dB means double the voltage in my book, so 61dBuV

equals 1.8mV. My AR88 can easily resolve 1uV at 13MHz and 30% AM modulation. It is no wonder I have a major problem. I tried ferrite clamps on the PV leads, the battery leads and the AC output from the inverter but these were not nearly enough to suppress the problem to a usable level especially for the lower amateur bands. Incidentally, a friend of mine recently told me that someone in East Lothian just put his brand new transceiver (£900) on GumTree as "his neighbour just installed solar panels".



Don's AR-88 receiver. The UK ordered these in large quantities from the US under the lend-lease act of October 1941. Many of them were deployed through a network of 'Y' Stations spread throughout the UK and in the field. They were used to intercept enemy communications and to provide the raw material for decryption at Bletchley Park.

BRITISH BROADCASTING CONFUSION

The Crowning of a Charade

*The Eleventh in a Continuing Series of Monographs
by Mervyn Hagger*

It's a very basic wall plaque that adorns a wall at 202 Bath Street within the Charing Cross area of Glasgow. It says a lot, and yet it says nothing. In some ways it is like a character generator used to insert headline-attracting message crawls shown at the bottom of television screens. [1]

When I began this series in 2021 [2], it was to explain the results of a conundrum that confronted me on Saturday, October 25, 2014. That is when I set out to deliver a lecture about Radio Caroline. Unfortunately for me, I had just read a book [3] published by the authoritative Institution of Electrical Engineers which debunked everything that I thought that I knew about this subject. So, I then set about trying to find the answers, and then, after years of research I found what I thought were the definitive answers, but in reality, on Saturday, February 15, 2025, I had merely walked myself backwards into a repeat performance of my first lecture.

I called my second attempt *An Expose of the Palimpsest Hoax*, but only now, after trying to explain the meaning behind that Bath Street wall plaque, have I begun to grasp the enormity of the task I have set out to



accomplish. To be honest, it is more than I can achieve by myself, because at almost every turn I have discovered that what everyone has accepted as the story of British broadcasting, is either not true at all, or it is a partial rendition of the truth, and it would be tossed out in a court of law as perjury.

With that caveat in place, let's take another look at what that Bath Street plaque actually says. It begins with a numeral and two letters: '5SC' and they are followed by: 'On 6th March 1923 the first radio studios of the BBC in Scotland were inaugurated in this building.' The plaque ends with the initials 'BBC'.

In one sense this story, has no single point of origination, because there are also three stands in the broadcasting chronology behind the initials 'BBC'. These strands are intertwined with

each other. In no particular order of importance, they are legislative thread [4], inventive thread [5] and biographical thread [6].

But the story of mass messaging by means of electrical equipment has a self-limiting storyline, because it ignores a much bigger picture. In this instance, it is the control of both the message and the medium [7] which this commentary is focused upon. It is also the point at which Marshall McLuhan collided with George Orwell [8].

However, while McLuhan's expression tends to be interpreted as a reference to messaging by electronic distribution while excluding the coequal part played by print media, that reduction obfuscates the actual story behind the creation of the initials 'BBC'. Now add an Orwellian twist that involves a hidden hand [9] manipulating observed events, and this story becomes even more distorted and fantastic in its repeated recitals.

But why hasn't any of this been documented before now? Well, in a sense it has, but that documentation is in a figurative "million pieces", and therefore many writers attempting to write their own thesis takes the easy road by citing the works of someone else, while performing a minimal amount of original research.

Wikipedia was built upon the premise that original research would not be considered for publication. While academia frowns upon works citing Wikipedia, search machines

using AI tend to use Wikipedia as their first port of call.

WORDS ON THE WALL

This eponymous plaque does not celebrate the first radio station in Scotland, or even the first broadcasting station in Glasgow. This plaque merely notes that this is where the first radio studios of something called 'BBC' were 'inaugurated'. Those studios were not created by the British Broadcasting Company Limited, but by another radio station with the call letters 5MG. Its studio equipment had been built by wireless enthusiast James Cameron and installed in a flat at 141 Bath Street. Its new location was at 202 Bath Street, diagonally across the road and inside an office above a street-level household appliance shop at Rex House.

The GPO licence for 5MG had been issued to the British General Electric Company Limited as an experimental station. In addition to James Cameron, 5MG was managed by Frank Milligan who owned a wireless shop on Renfrew Street selling GEC products. At 202 Bath Street, their colleague George Garscadden owned the appliance shop.

Although 5MG preceded 5SC on the Glasgow airwaves, it is not listed as being the first radio station broadcasting to Scotland, because it had been a somewhat sporadic affair. But in October 1922, following its relocation, 5MG began broadcasting a variety of programmes prior to 5SC

receiving a GPO licence to broadcast as the Glasgow station of the British Broadcasting Company Limited.

The reason for this 5MG to 5SC transition is due to the GPO awarding the first Scottish licence to 2BP, a station operated by Marconi's Wireless Telegraph Limited. 2BP was also another sponsored station like Marconi's MZX two years earlier which transmitted the famous Dame Nellie Melba performance. But, where that broadcast was paid for by the *Daily Mail*, this Marconi station had sold its airtime to the Daimler Car Company, and it broadcast from a studio located inside the Daimler showroom at Kelvinside in Glasgow.

2BP first went on the air during Wednesday, 24 January 1923, and its transmissions were timed to coincide with the opening of the Scottish Motor Show held in Glasgow. The primary function of 2BP was to promote, by demonstration, the installation of a Marconiphone radio receiver inside a Daimler car. However, 2BP also provided both musical entertainment and even a religious church service in its programming schedule.

At the close of the Motor Show on February 3, 1923, station 2BP signed off the airwaves from Glasgow, and it was then that 5MG filled the gap with additional programming until it was succeeded by the start of 5SC.

It is possible that 2BP was initially created by Marconi's Wireless Telegraph Company Limited to coincide with the opening of the Olympia Motor Show in London

during November 1922, before its transmitter was transported to Glasgow for about ten days. 2BP was then moved yet again. This time to the emerging Irish Free State, where, momentarily in August 1923, it became noted as the first station on air in Ireland [10]. This time 2BP was used to promote a horse show, but while it was recorded as being the first station to broadcast in southern Ireland, it was almost immediately shut down when the 2BP licence was revoked due to the turbulent political scene.

EVERYTHING IN THREES

Downplayed as the motivation behind the arrival of British broadcasting is the fact that it was funded by commercial sponsorship in conjunction with the print media. It was not some sort of lofty public-spirited gifting to the enlightenment of the British people by wireless manufacturers. To understand why this is the case, it is necessary to note the arrival of exploitive British newspaper publishing. It began during the supposedly staid reign of Queen Victoria towards the latter part of the Nineteenth Century.

There were three major players in print connected to the story of British broadcasting. The first was George Newnes [11] who on October 22, 1881, began publishing short items [12] for the masses delivered in a newsprint format. One of his contributors was Alfred Harmsworth [13]. Harmsworth became the founding publisher of both the *Daily*

Mirror and *Daily Mail*, with the latter becoming a sponsor of commercial radio broadcasting [14]. He achieved this from both within Britain by GPO licenced transmissions, and externally via a station that was located outside of GPO jurisdiction.

A previous article in this series [15] has covered the part played by Harmsworth in sponsoring the performance of June 15, 1920 by Dame Melba over Marconi's MZX. The signal was received throughout Europe and as far as Newfoundland and it sparked fierce response from the British Admiralty. The U.S. Navy had previously taken a similar restrictive attitude towards the private ownership of wireless telegraphy stations owned by American Marconi. They were a subsidiary of Marconi's Wireless Telegraphy Company Limited in Chelmsford, Essex and bought out to become the property of Radio Corporation of America, a new subsidiary of the American General Electric Company.

But in the instance of MZX, it was the beginning of a morphing process by the Crown to use an existing wireless telegraphy law to encompass wireless telephony broadcasting.

As the number of homemade and store-bought wireless telephony receiving sets increased during the early 1920s, the General Post Office came under extreme pressure from hobby listeners to allow experimental wireless telephony broadcasts to resume from British soil. On February 14, 1922, which was about two years

after its MZX transmission, the GPO issued Marconi's Wireless Telegraph Company Limited with a new experimental broadcasting licence for 2MT in Writtle. These transmissions began to push the boundaries of scientific research into the realm of homemade entertainment by recorded music and even audio play acting. On May 11, 1922, the Marconi company was issued another licence for experimental broadcasts. This station identified itself as "Marconi's London Wireless Station 2LO". But the Crown would not allow licences to be issued to companies for the overt purpose of providing mass entertainment.

This refusal by the GPO to licence British commercial broadcasts, resulted in the *Daily Mail* sponsoring ongoing gramophone and live concerts which had a sizable listenership in the British Isles. They were transmitted from July 1922 to July 1923 by station PCGG located in the Netherlands, and ended shortly before Harmsworth died on August 14, 1922.

The third member of this press triumvirate is John Scott-Taggart [16]. He was born in 1897, and after a decorated period of military service during World War I, he was demobilized in 1919 and joined the Edison Swan Electric Company (Ediswan) [17], where he took charge of their valve manufacturing plant.

The following year, Scott-Taggart left Ediswan for the Radio

Communication Company (RCC). He remained with this company until 1924 as both a research engineer and Manager of their Patent Department. Two years into his work at RCC, Scott-Taggart created a subsidiary company for his employer. It was incorporated as Radio Press Limited with RCC owning 75% of the shares and Scott-Taggart owning 25%. It was a prolific publisher, and Scott-Taggart did not shy away from self-promotion. His picture seems to have been everywhere pushing his own inventions and promoting his own products.

Radio Press Limited published technical journals, handbooks and magazines aimed at radio listeners. The company was so successful that it moved its operations into Bush House, long before the letters 'BBC' were attached to those premises. Eventually the Harmsworth publishing interests bought out Radio Press Ltd and Scott-Taggart began working for its Amalgamated Press company.

STRETCHING THE LAW AND THE IMAGINATION

The timeline that leads up to BBC 5SC via Marconi's 2BP, began with Marconi's MZX in Chelmsford. In 1922, agitation mounted to force the GPO to licence British broadcasting stations. Ironically, one of the representatives of those interests was the father of the future Member of Parliament Anthony Wedgwood Benn. In 1965, Tony Benn was

Postmaster General in the government headed by Prime Minister Harold Wilson. It was Tony Benn's job to create a legal method that would close down the so-called 'pirate' radio stations operating offshore and just outside British Territorial Waters, without costing the Labour Party too many votes at the next General Election.

On July 24, 1922, Captain William Wedgwood Benn, the father of Tony, asked the Postmaster General [18] what statutory authority he had to issue broadcasting licences. The answer he received was that "Statutory authority for the issue of licences to establish wireless stations is conferred by the Wireless Telegraph Act, 1904."

The problem with that law was that it pertained to wireless telephony and not to wireless telegraphy. Nevertheless, the issue with the current legislation was addressed by making multiple amendments to the laws already in place. They began with the distribution of letters in 1660, continued via telegraphy, included the use of electricity in street lighting, and then embraced the telephone, expanded to wireless telegraphy, which were all related to point-to-point communications. But it took a huge stretch of both law and imagination to include everyone and anyone, anywhere in the United Kingdom with a law regulating wireless telephony.

To be continued

FOOTNOTES

[1] In the USA, it is referred to by the brand name 'Chyron', and in the UK as 'Aston'. Each product evolved from two different companies.

[2] See: *Transmitting*, No.94, Spring, 2021, p.16 ff.

[3] *Radio Man: The Remarkable Rise and Fall of C.O. Stanley*, by Mark Frankland and Gordon Bussey. 2002.

[4] See: *Common Sense*, by Tony Benn, Hutchinson, London, 1993, p.73 and the establishment of the Royal Mail (General Post Office) in 1660, during the creation of a new monarchy under King Charles II.

[5] Telegraph, Wireless Telegraph, Telephony, Wireless Telephony (*Radio Broadcasting*).

[6] Individual pioneers who contributed to the development of mass communications.

[7] See: The thesis which famously claimed that "The medium is the message" in *Understanding Media: The Extensions of Man* by Marshall McLuhan, Mentor, NY, 1964.

[8] "Who controls the past controls the future: who controls the present controls the past." Cited in *Nineteen Eighty-Four* by George Orwell.

[9] The 'Big Brother' factor which is represented by the Crown as a corporation sole and an agenda that is set in 2050 after a Woke introduction.

[10] On August 14, 1923, 2BP briefly became the first licenced station in the Irish Free State, broadcasting from the Royal Marine Hotel in Dún Laoghaire. The purpose

of this Marconi station was to provide news and entertainment relating to the Royal Dublin Society horse show. See: *The History of 2BP: Ireland's First Licensed Radio Station* by Eddie Bohan - 2023.

[11] Sir George Newnes, 1st Baronet, March 13, 1851 – June 9, 1910. He was also elected to Parliament for two decades as a Member for the Liberal Party.

[12] Newnes created *Tit-Bits* on October 22, 1881, to which Harmsworth contributed. He also delivered Sherlock Holmes to the masses in *The Strand Magazine*.

[13] Alfred Charles William Harmsworth, 1st Viscount Northcliffe, July 15, 1865 – August 14, 1922. See: p.22, *Transmitting*, No.101, February 2023.

[14] Commercial radio being defined in his instance as sponsored programming, rather than 'spot' advertising.

[15] See: *Transmitting*, No.102, June 2023, p.10 ff.

[6] John Scott-Taggart (1897–1979) was a British veteran of both World Wars, a Wing-Commander awarded the OBE and the Military Cross; a radio engineer, publisher and barrister-at-law.

[17] In 1920, Ediswan was a British manufacturer of electric lamps and radio technology which in 1926 became part of the British Thomson-Houston company, a subsidiary of the U.S. General Electric Company.

[18] HC Deb 24 July 1922 vol 157 c50W.

CRYPTO KEYS EXPLAINED

A short overview of when and why crypto keys are used, how they are created and how they get to where they are needed.

Flt. Lt. 'Phil' Philipps RAF (Retd)

It is likely that you are aware of the modern use of encryption in protection of financial transactions - almost invisible to the general public and of network traffic on the Internet. These have been around for several decades and are studied intently at academic and Governmental research centres. Their principles are well-documented and widely known and much effort is put into discovering weaknesses and ways to break their security. In this short article I intend to cover how crypto keys have become essential to modern society, the military and us as individuals.

EARLY MANUAL ENCRYPTION METHODS

A recent archeological discovery has revealed an early use of codes in business in Asia. The use by the Greeks of a simple stick, a Scytale, where a message was encoded by wrapping a tape around it and writing the message. The intended recipient needed a matching stick that would reveal how the message letters really were arranged [1].

The Caesar cypher is, of course, easy to break as each letter encodes to its same alternative every time it occurs and a few trials of different shifts of the encoded text should

reveal recognisable words and hence "the key" which in this case is how many shifts along the alphabet was the one used, so if A => D then CAT=> FDX and so on. "Simples!" as our Meerkat friends would say. An alternative is to count the frequency of each letter's occurrence - and with a knowledge of the target language e.g. English common letters like E,T,A stand out as would common words like "the" or words used in the context of the message such as "Daily Report" that helped break German Weather cyphers in WW2.

CODES v CYPHERS

Codes are still used as a means to shorten messages - originally for when channel bandwidth was limited such as early telegraphy or to cover the meaning of a message; these often relied on a list shared between two (or more) correspondents. Some codes played an important role in naval telegraphy and diplomatic telegrams but also in commercial trading. So a list of ports could be made that might use a 4 or 5 digit number selected randomly when the list was created, or simple instructions like "buy" or "sell" or "hold" coupled with a coded list of stocks and shares. Codes can also be used to send short-burst spy/military messages - short to

avoid D/F-ing of the sender's TX.

Cyphers have taken many forms over the millennia; Their interesting and even exciting history has prompted research into their construction, use and how they have played a part in major elements of world history. Cyphers that use letter replacement methods are generally classed as substitution cyphers - the most easy and well-known is the Caesar cypher that simply replaces an alphabet with an identical alphabet but starting a number of steps along the original alphabet so e.g. A=>L, B=>M, etc. Another is the "Dancing Men" cypher where letters were replaced with a similitude of a man waving flags as in semaphore signalling at sea. A famous Sherlock Holmes story builds on this cipher.

Another well-known cypher is the Vernam cypher that originally used a square table of alphabets that have different ordered alphabets in each row. That enables a greater degree of obfuscation and if used correctly with a one-time pad or unique random keystream is considered unbreakable. Paper and pencil methods are tedious but doable for short messages, and mechanical versions require a random source (at each end) that has been produced and distributed securely, and destroyed after its once-only Use. Any repeat or excessively long message that incurs re-use of the random source invites message decryption.

Here is a list of important (in their own time) ciphers:

Scytale. ...

Caesar Cipher. ...

Freemason Cipher/Pigpen Cipher. ...

Great Cipher of Louis XIV. ...

The Jefferson Wheel Cipher. ...

MECHANICAL ENCRYPTORS

An early example is the Jefferson wheel cypher where a rod is threaded through a series of discs each bearing an disordered alphabet that can be turned to display the plaintext and a encrypted version read from e.g. the next row of letters. Re-arranging the order of the discs to some new but previously agreed order will change the cyphertext for the next message. In effect this was a principle followed in the well-known Enigma machine.

Other portable mechanical encryptors were later made such as the American M209 used in WW2. In this case the machine was pocket-sized and was used for tactical messaging by the military. A number of mechanical encryptors were developed in the 1920's in Germany and these led to the commercial Enigma machines of various designs prior to adoption by Germany for military and diplomatic traffic. Reference [2] has a wide range of illustrations and details of various countries machines.

ELECTROMECHANICAL ENCRYPTORS

A whole range of electromechanical encryptors was developed by various countries, the most well-known being



Intercept operator at Beaumanor Hall, Leicestershire, the War Office 'Y' Group's principal listening station, which provided much of the raw material for decryption and traffic analysis at Bletchley Park. Beaumanor's role is often overlooked.

Enigma for Medium grade cyphering and the Siemens & Halske T52 teleprinter direct encipher/decipher machine for High-grade traffic - broken by the development of Colossus by Tommy Flowers and used at Bletchley Park in WW2.

The T52 used a mechanised Vernam cipher with more wheels than Enigma. The whole story of how it was broken is a subject in itself and

Enigma machine at the mobile field headquarters of General Heinz Wilhelm Guderian (centre) during the invasion of France in 1940. The system proved to have significant weaknesses and was less secure than the Germans imagined

a visit to Bletchley Park to see how the primitive "Heath Robinson" set-up was transformed into a faster electronic machine is well-justified.

ELECTRONIC ENCRYPTORS

Electromechanical encryptors persisted for many decades after WW2 as Enigma machines were encouraged by the British for use in "friendly" countries unaware of the UK's ability to read the traffic.

Surprisingly, a miniature valve-based (900 valves) was produced by the US. However the advent of transistors and then microcircuits, coupled with binary logic gates in ever-increasing numbers, meant the development of practical fully electronic devices soon followed. Initially the designs incorporated electronic versions of earlier encoding methods but the recognition of the XOR gate to which a binary text stream and a pseudo-random generator were applied produced an output that was also (pseudo) random and prevented the earlier forms of attack (if used properly - ahem!) and the generator was capable of producing a very, very long cycle - pseudo-random number generation [3] is a whole further topic as they are required for other purposes than just encryption.

Genuine random number generators [4] also exist, such as Ernie - the Premium Bond machine, but being genuinely random cannot be used directly as encryptors but could be used to generate the required random keystream when that was being recorded and physically sent to the intended traffic recipient(s) - a right pfaaf and long since overtaken by mathematical options.

SOFTWARE ENCRYPTION

Software encryption can emulate any of the many past methods described or mentioned above, and decryption or breaking of unknown cyphers can

use the immense performance obtainable from single or networked computers. The widely known PGP (Pretty Good Privacy) is now 34 years old but still appreciated by those concerned for their privacy. Its functionality is available as GPG [5] basically a free Opensource suite that utilises the best published encryption methods such as AES256 for the encryption, and RSA or Diffie-Helman for key generation, and SSH for securing the transfer of administration of web-servers. Messages/files can be signed with a secure hash. There is a commercial version (PGP) with an associated fee-based support service.

KEY GENERATION

Early methods didn't require the elaborate key structures of today's secured systems, but an agreed clue (key?) as to the relevant book-page(s)-lines-word that were to be used in a cypher system - on the principle that a certain source would be available at send and receive sites.

Obviously the Bible (an agreed version) might be most common but any published text could be used without drawing attention if in wide availability. As mentioned above, a random generator could be used if the overall system incorporated a secure method of copying and distributing the random stream - often a tedious and expensive procedure.

Modern systems rely (at present)

on NP-hard mathematical challenges such as solving the prime numbers that make up a huge number (in binary a number of 2-3000+ bits for RSA, somewhat less for Elliptic Curve encryption).

Be warned! you will enter the deepest of rabbit holes when enquiring further into the latest methods and their limitations but it is a "Watch this space" subject especially as Quantum computers are growing in capability. NSA notwithstanding, NIST foresee a 5 year future for current methods of encryption before Foreign State Actor level capabilities threaten National Security usage.

KEY SECURITY AND DISTRIBUTION - A REAL WORLD EXPERIENCE

From the late 60's, I began taking on responsibilities for hi-grade security equipment and for keys, holding, distribution and destruction. Life underground behind several vault doors and continuous accountability for flimsy but highly sensitive one-time pads influenced every moment - even after leaving work as normal a moment's concern about, "Did I lock that box?" holding key material (old or new) even though the box was kept in a safe in a secure room extension off the communications centre that was secured by combination lock covered key-holes in a guarded bunker...resulting in a return drive to work to check, as the deputy custodian would have to report a

breach if he had occasion to check or actually perform a key exchange in my absence. As he was three grades higher and responsible for the site it would be unthinkable for him to not to carry out disciplinary and reporting action if a key-pad stock was thought to have been open to compromise.

A comparable responsibility at a large bank involved four of us as managers each, in turn, entering the 4x four-character code for the UK ATM system at that time using a DES implementation. Today's systems enjoy remote key distribution for the many thousands of connected devices but similar responsibilities for system administration.

QUANTUM COMPUTING AND COMMUNICATION

Viable quantum computing is with us but not quite on an industrial scale, but quantum communication has been feasible for more than a decade; The communication has used single photon transmission over fibre optic or laser open air paths and any interception effectively signals itself to the receiver.

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- [4] https://en.wikipedia.org/wiki/Random_number_generation
- [5] https://en.wikipedia.org/wiki/GNU_Privacy_Guard

THE ALEXANDER BAIN, WICK

A pub review in *Transmitting*? Well, not quite. On a visit to Wick in July this year, Sheila and I were surprised to find the local Wetherspoon's pub named after the pioneering inventor Alexander Bain, who featured in our 2009 Exhibition *Great Scots Who Changed the World*.

The pub is built on the site of the clockmaker's workshop where Bain served his apprenticeship. The

present building opened in 1914 and housed the telegraph and telephone offices as well as serving as the town's main post office until the 1990s.

In September, Wetherspoons sold the pub to a locally-based hospitality group.. Sadly, the new owners have not retained the 'Alexander Bain' name. It is now known as the Riverhouse Bar & Grill.

David W. Brown



Above: Wetherspoons acknowledged Bain's achievements on this plaque. It is not known if the present owners have retained any references to him.

Left: The building in July 2025, when it was still owned by Wetherspoons.

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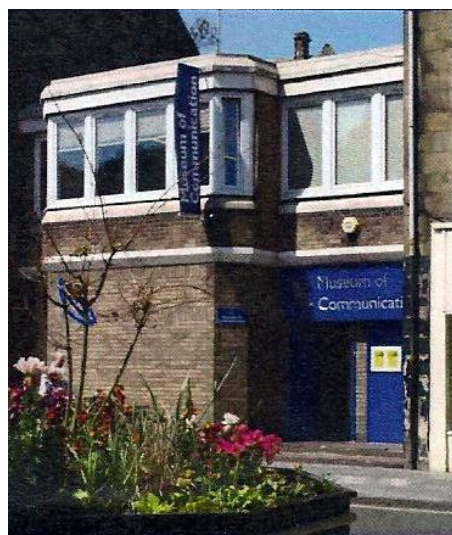
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